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Assessing a garden-based curriculum for elementary youth in Iowa

by

Kimberly Rochelle Hilgers

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Horticulture

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Signatures have been redacted for privacy

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CHAPTER 1. GENERAL INTRODUCTION

Introduction

The connection between horticulture, education, and youth can be traced back to at least 1837 in Germany. Educational philosopher Fredrich Froebel combined these elements into a child's garden concept for nurturing and educating young minds; or what we know now as Kindergarten (Polito, 1995). His insight to use a child's connection with nature to educate through exploration and interaction was the founding principle for today's gardening curricula.

Modern studies have shown that the mere hands-on nature of gardening motivates student learning (Relf and Lohr, 2003). A survey of elementary education teachers in Virginia found that 85% of respondents currently used plants or seeds in their classrooms (Dobbs et al., 1998). The same survey also indicated a strong need for organized materials such as lesson plans or activities in order to successfully incorporate horticultural information into the classroom curriculum.

Various garden-based curricula have been created for use in classrooms (Meyer et al., 2001). *GrowLab* is a garden-based curriculum developed cooperatively by the National Gardening Association and the National Science Foundation. It was developed in 1990 and focuses on national science standards issues for grades K-8 (Pranis and Cohen, 1990). Another popular curriculum is the *Junior Master Gardener* program (JMG) created by Texas A&M University in 1999, prompted by the widespread popularity of the Master Gardener program. It targets youth ages 9-19 and incorporates many scholastic disciplines as well as leadership and life-skills through primarily horticultural and environmental lessons (Welsh,

et al., 1999). While these are only a sample of curricula on the market, they are by far the most widely used in the U.S. today. Iowa State University Extension developed the *Growing in the Garden* (GITG) curriculum in 2000 to promote many of the same goals as the JMG program while targeting a younger, K-3 audience. An area of differentiation, however, is that while the JMG program requires the use of actual garden facilities for many of its lessons, a garden is not required for successful use of GITG lessons. Outdoor garden facilities are often a key component of garden-based or horticultural curricula (DeMarco et al., 1999). While the number of school gardens in the United States continues to rise, the majority of schools still lack such resources. The GITG curriculum provides additional lessons involving a garden site as an optional supplement to the core lessons.

Interest in and potential use of garden-based curricula in elementary schools in the U.S. seems to be increasing. Teachers responding to a survey indicated a high to moderate level of interest in such programs (88%), while only 2% of those interested indicated they were currently using a horticultural curriculum (Dobbs et. al., 1998). Therefore, interest and availability of garden-based curricula does not necessarily translate into use of such curriculum in classrooms. There are many possible reasons for hesitation in incorporating garden-based curricula, such as personal comfort level of teachers on the subject matter, pressures to focus on reading and writing achievement in early elementary, lack of administrative support, or cost of the programs (Klemmer et al., 2005; Meyers et al., 2001; St. John et al., 2003). Research and evaluation of curricula allows teachers to see a solid connection between their own objectives and the success of the curricula before allocating precious time or money to new programs (De Marco et. al., 1999; Klemmer et al., 2005; Phibbs and Relf, 2005). This study examined if the GITG curriculum could positively

impact the interest and awareness of first graders in the areas of science, nutrition, and environmental awareness.

Thesis Organization

Chapter 2 of this thesis is a literature review that discusses previous research findings on the rising interest and use of garden-based curricula, the importance of the areas of science, nutrition, and environmental awareness in elementary education, and various methods and challenges of curricular assessment. Chapter 3 is a manuscript for submission to *HortTechnology* which discusses research conducted in spring of 2005. Chapter 4 discusses conclusions and implications of the research followed by an appendix.

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CHAPTER 2. LITERATURE REVIEW

Garden-based Curricula

Garden-based curricula for elementary students vary greatly by content, objectives, methodology, and applications. It is no surprise that research involving such curricula varies greatly as well. The main topics of interest in recent research include health or nutrition, environmental education, self-esteem or self-concept, academic achievement, and life skills (Phibbs and Relf, 2005). While many garden-based or horticultural curricula exist for youth, (Klemmer, et al., 2005a) the *Junior Master Gardener* (JMG) program from Texas A&M University has been the program of choice for most recent research. Meyer et al. (2001) evaluated the JMG program for suitability in a public classroom setting. Student and teacher response to the program was positive, but the cost of the workbooks was a concern. This study did not address student achievement or knowledge gain in any particular subject area. Dirks and Orvis (2005) evaluated the JMG program for improved agricultural awareness and knowledge in an elementary classroom setting. Knowledge gain and positive changes in attitudes were found. Science achievement of elementary students using the JMG program through teacher delivery was evaluated by Klemmer et al. (2005b). Significant increases in achievement were observed in 5th grade students, but not in 3rd or 4th graders. Smith and Motsenbocker (2005) also conducted in-school evaluation of the JMG program in science achievement of 5th graders. Their study differed from Klemmer's as lessons were conducted by Master Gardener volunteers and involved inner city youth, as opposed to youth from predominantly rural and suburban areas used in the previously mentioned studies. Increases in science achievement were noted in Smith and Motsenbocker's study (2005). Posten et al.

(2005) used a slightly different approach and focused on an after-school environment to compare the more hands-on gardening curriculum of the JMG program with a more traditional classroom-based program to evaluate impact on nutrition knowledge and preferences in 3-5 graders. No increase in nutrition knowledge or fruit and vegetable consumption habits were found as a result of either program. The variety of studies conducted using the JMG program alone reflect the variety of subject content that can be incorporated in garden-based curricula. This study will address the areas of science, nutrition, and environmental awareness.

Science

With the current focus in early elementary grades on reading and writing (St. John et al., 2003), science tends to be overlooked. Many teachers admit to avoiding teaching science in the classroom due to their own anxieties and perceived lack of science content knowledge (Rigden, 1999). However, beginning in 2007-2008, science will become a component of the No Child Left Behind act, thereby increasing the requirement of science instruction and knowledge gain in the classroom (Buckendahl et al., 2005). Elementary teachers feel frustrated by a lack of good science standards-based curriculum available to them (Rios, 2003). Since many garden-based curricula include lessons based on local or national science standards, they may prove to be viable options for science instruction. In addition, research shows that negative attitudes towards science are developed before students reach high school (Gilroy, 2002). Positive attitudes towards science developed early, fostered by garden-based curricula, may prove significant in maintaining positive attitudes towards advanced education in the sciences (Tanner, 1980). Garden-based curricula offer

opportunities to experience scientific concepts such as the scientific method, data collection and analysis, interdependence, the effects of weather, and biology (Mohrmann, 1999).

Hands-on experimentation with plants may motivate student learning and make science lessons more meaningful (Scruggs and Mastropieri, 1995). Marginal evidence of increased science achievement has been shown with the JMG program (Klemmer et al., 2005b; Smith and Motsenbocker, 2005).

Nutrition

An alarming number of children in the U.S. are overweight and the numbers continue to rise (Troiana and Flegal, 1998). Understanding where food comes from and what it does for the body are important pieces of knowledge to enable good choices that lead to lifelong health (Harvard School of Public Health, 2005). Since food is almost wholly derived, ultimately, from plants, garden-based curriculum may be an effective way to teach nutrition (Morris and Zindenberg-Cherr, 2002). Schools play a critical role in nutrition education not only to encourage physical health of students, but also to increase educational achievement promoted by proper nutrition (Briggs et al., 2003). School gardens can improve nutritional knowledge and preferences for vegetables in elementary students (Graham et al., 2005). In California, a school that combined a gardening program with nutritional education saw a 10% increase in fruit and vegetable consumption among participants (Twiss et al., 2003). Morris and Zindenberg-Cherr (2002) concluded that nutritional lessons supplemented with garden-based activities significantly increased preferences for certain vegetables and maintained their significance at a six-month follow-up. While nutritional lessons alone also showed significant improvement over control groups initially, they failed to hold their

significance, indicating that the garden-based activities promoted longer-lasting effects.

Another study found that a garden program increased positive attitudes in 4th graders towards vegetables, but not towards fruits (Lineberger and Zajicek, 2000). Researchers noted that the lack of change in fruit preferences could have been due to a higher baseline preference. The same study reported no change in the 3rd and 5th graders' consumption of fruits or vegetables. Another study targeting citrus fruits, however, found that while students' attitudes towards citrus fruits in general did not change after application of a horticultural program, their snack preferences towards citrus improved (Koch et al., 2005). While these studies show varying results, schools continue to try methods to promote nutrition education, especially since funding is available to schools promoting nutritional education (USDA, 2005).

Environmental Awareness

Gardening was once an integral part of childhood development (Relf and Lohr, 2003). Urbanization and subsequent detachment from nature have resulted in a lack of environmental contact and a subsequent decrease of awareness (Cohen et al., 1993). The very concept of garden-based curriculum promotes an understanding of the complexities and interdependencies of life. Athman and Monroe (2001) stressed the importance of environmental literacy, which, in addition to knowledge, includes attitudinal and behavioral components. Attitudes towards the environment begin developing very early in life, before adolescence (Campbell et al., 1997). Implementation of environmental programs can foster an appreciation of the environment (Rahm, 1999). The mere presence and interaction with a children's garden resulted in knowledge gain and respect for the environment in preschoolers (Midden and Chambers, 2000). Skelly and Zajicek (1998) reported an increase in positive

environmental attitudes of 2nd and 4th grade students participating in a garden-based curriculum. The effectiveness of such programs in promoting behavior change is less certain (Yerkes and Haras, 1997). Culen and Mony (2003) found that while participation in an environmental education program by 4-H youth in Florida resulted in increased literacy in the subject area, it did not significantly change behavior. The study suggested that the curricula used lacked investigative, evaluative, and or action components for developing skills necessary to promote change in behavior.

Curricular Assessment

While the amount of research concerning garden-based curricula is rising, such research is complicated and many studies lack the scientific substance necessary to substantiate drawn conclusions (Phibbs and Relf, 2005). Documented assessment is essential for teachers to devote precious time or administration to allocate funding to new curricula (De Marco et. al., 1999; Klemmer et al., 2005a; Phibbs and Relf, 2005). Elementary teachers who use plants or seeds in their classrooms often resort to purchasing supplies themselves or searching for outside funding (Dobbs et al., 1998). The methods of evaluating garden-based curricula vary greatly. Quantitative assessment methods, while seemingly more valid, may miss important data in an attempt to control a number of inevitable variables when dealing with human subjects while qualitative methods alone rely heavily on subjective data (Waliczek et al., 2003). Exclusively quantitative or qualitative designs are rare and many studies incorporate a combination of the two methods. Likewise, combinations of experimental and observational studies often result in hybrids also referred to as quasiexperimental designs.

Surveys and questionnaires are commonly used in people-plant research (Shoemaker et al., 2000). Delivery methods may include mailed, phone, or internet questionnaires and questions are either closed, as in yes or no, multiple choice, or likert rating questions, or open, allowing the respondent to answer the question freely. Often surveys may contain both closed and open questions, as in the surveys conducted by Phibbs and Relf (2005) and O'Callaghan (2005). Questions can be either quantitative, ie. asking for a particular number of times a respondent has made a particular choice, or qualitative where the question may be asking about the way a respondent feels about a subject.

In addition to surveys, curricular assessment can also be performed by experimental design. A study by Klemmer et al. (2005a) developed a test instrument to evaluate achievement in science standards after experiencing a garden-based curriculum. The instrument developed was geared towards evaluation of students in grades 3-5 and consisted of a traditional written test with multiple choice answers. The test instrument was delivered to experimental (those receiving the garden-based curricula) and control (those receiving traditional instruction) classrooms after the completion of the lessons (Klemmer et al, 2005b). Smith and Motsenbocker (2005) also used experimental and control groups with 5th graders, but used pre and post tests to determine science achievement, vs. strictly post evaluation. While multiple choice exams may provide for ease in analysis, they can also be misleading in identifying the student's true knowledge, especially when the concept of guessing is involved (Lederman et al., 1998; Wang, 1995). Pre and post testing may have an advantage over post lesson evaluation alone as it gives a baseline of prior knowledge. As stated previously, however, an increase in knowledge gain is not always parallel to behavior change. Evaluating behavior can be more difficult and requires long-term evaluation and follow-up

not always possible in research studies (Phibbs and Relf, 2005). To evaluate behavior, researchers rely on observational studies or measures of self-reported efficacy (Poston, et al., 2005).

Young learners (K-3) possess limited reading and writing skills, which makes assessment in early elementary grades difficult (Helm and Groulund, 2000). Children between the ages of 5 and 8 vary greatly in their cognitive abilities and motor skill development, making traditional paper and pencil assessment inappropriate (Doak and Chapman, 1994). Midden and Chambers (2000) used several methods in combination to evaluate knowledge gain in preschoolers such as a likert scale with smiley and frowning faces as response options, student drawings and interviews, teacher questionnaires and a teacher journal consisting of comments, photos, stories and drawings. While observation is a popular means of assessing young children (Criswell and Criswell, 1995), classroom time constraints make it difficult for individual student assessment by teachers. Boudreau (2005) found parental questionnaires reliable compared to more formal literacy testing in young children. Parental observation also allowed for evaluation of interest and behaviors outside of the school environment. Ultimately, familiarity with multiple research methodologies leads to successful people-plant research design (Shoemaker, et al.2000).

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CHAPTER 3. “ASSESSING A GARDEN-BASED CURRICULUM FOR ELEMENTARY YOUTH IN IOWA: PARENTAL PERCEPTIONS OF CHANGE”

A paper to be submitted to HortTechnology

Kimberly Hilgers, Cynthia Haynes, and Joanne Olson

Abstract

The interest and use of gardens as educational tools for youth has increased in recent decades. The positive connection found between children and horticulture has prompted the development of garden-based curricula for use in schools. Iowa State University Extension developed the Growing in the Garden (GITG) curriculum designed for use in K-3 classrooms. This study examined what impact the GITG curriculum had on the awareness and interest of first graders in the areas of science, nutrition, and environmental awareness. Impact was assessed by a parental survey asking for perceptions of their child’s interest and awareness after experiencing three lessons from the GITG curriculum. The sample consisted of 78 parents of first grade students in 4 classrooms in Iowa. Results indicate that a majority of parents completing the survey perceived a positive change in the awareness and interest of their children in the areas of science and environmental awareness. Positive increases in nutritional awareness and interest were perceived by some parents, though not enough to constitute a statistical majority. Factors such as socio-economic status, ethnicity, and gender did not greatly influence the outcomes.

Introduction

The interest and use of gardens as educational tools for youth has increased in recent decades (Dirks and Orvis, 2005; Lineberger and Zajicek, 2000). The American Horticulture Society's 1993 drive to incorporate school gardens into educational school curricula has partly fostered this trend (Sealy, 2001). As the interest in school gardens has increased, so has the amount of research relating to children and horticulture. Many studies relate to psychological and emotional responses of people to plant interaction (Relf and Lohr, 2003). Research points to the mere presence of plant material as therapeutic, improving concentration and behavior of children with ADD (Taylor et. al., 2001; Wells, 2000). Rahm (1999) showed that youth gained appreciation and awareness for the natural world through their garden-based activities. Horticulture has also been utilized as a tool to improve attitudes of youth at risk (McGuinn et. al., 2001).

The positive connections found between children and horticulture has prompted the development of garden-based curricula such as GrowLab, developed by the National Gardening Association, and the *Junior Master Gardener* program (JMG), developed by Texas A&M University (Meyer et. al., 2001). The JMG program is the most highly researched of the youth garden curricula and is nationally implemented by 28 University Extension Cooperatives (Dirks and Orvis, 2005; Texas A&M, 2005; Meyer et al., 2001; O'Callaghan, 2005; Smith and Motsenberger, 2005) . Developed in 1999, it targets youth ages 9-19 and incorporates many scholastic disciplines as well as leadership and life-skills in its primarily horticultural and environmental lessons (Welsh, et al., 1999). The JMG program has been shown to increase youth interest in gardening, increase science achievement, and enhance appreciation of the environment and nature (Meyer et. al., 2001;

Dirks and Orvis, 2005; Motsenbocker and Smith, 2003). Iowa State University Extension developed the *Growing in the Garden* (GITG) curriculum to promote many of the same goals as the JMG program while targeting a younger audience, but has yet to undergo formal assessment.

This study examined if the GITG curriculum could positively impact the interest and awareness of first graders in the areas of science, nutrition, and environmental awareness. Assessment of impact was determined by a survey of parental perceptions of their child's behavior after experiencing three lessons from the GITG curriculum. Research and evaluation allows teachers to see the impact of a curriculum before allocating precious time or money to new programs (De Marco et. al., 1999; Klemmer et al., 2005; Phibbs and Relf, 2005). It is anticipated that connections between proven impacts of GITG and teacher objectives may increase the effective use of the curriculum by schools.

Materials & Methods

Growing in the Garden

The GITG curriculum was piloted in 1998 and 1999 and released throughout Iowa in 2000. It was written primarily for early elementary K-3 students. Unlike many garden-based programs, the curriculum was designed for use in a classroom setting while allowing for expansion into a garden environment. Lessons follow a thematic scope that integrates various subjects, concepts, and life skills (Anderson, 2000). In 2003 the GITG curriculum was identified as one of the top new gardening programs by the National Gardening Association (Iowa State University Extension, 2001). Teachers are trained in lesson implementation, and are offered insight to additional resources and connections between

units and standards and benchmarks. Since its inception, nearly 2,900 teachers in Iowa have received GITG training. Initially the curriculum was provided free to Iowa teachers that attended training. It is now a cost publication available nationwide and out-of-state training is available.

Survey Development

The young age of students receiving lessons in this study posed several assessment issues. Children between the ages of 5 and 8 vary greatly in their cognitive abilities and motor skill development, making traditional paper and pencil assessment inappropriate (Doak and Chapman, 1994). While observation is a popular means of assessing young children (Criswell and Criswell, 1995), classroom time constraints make it difficult for individual student assessment by teachers. Therefore, parents of first graders were asked to evaluate perceived changes in their children in the form of a written survey questionnaire. Boudreau (2005) found parental questionnaires reliable compared to more formal literacy testing in young children. Parental observation also allowed for evaluation of interest and behaviors outside of the school environment.

The survey instrument contained 12 yes or no questions with space provided after each question for additional comments, thoughts, or observations. There were four questions in each of the three areas of Science, Nutrition, and Environmental Awareness (Table 1). These questions related to the content, goals, and objectives for lessons in the GITG curriculum. Demographic information was also requested.

Validity

Content validity of the survey instrument was established by a science education evaluation professional in the Department of Curriculum and Instruction at Iowa State University. Readability of the survey instrument was established by a survey professional at the Center for Survey Statistics and Methodology at Iowa State University. The survey tool was purposefully kept brief and simple for ease in completion and to increase response rates. Surveys were translated into Spanish and Bosnian and distributed to those parents who were not fluent in English.

Curriculum Implementation

A youth specialist from Iowa State University Extension offered a unique opportunity for consistency within this study. The specialist traveled to four, first-grade classrooms located in two schools in the Waterloo and New Hartford districts in north central Iowa. Implementation of GITG curriculum lessons occurred from April 11 to May 4, 2005. The use of one instructor in all classrooms provided consistency between repeated lessons. The classrooms ranged in size from 18 to 20 students for a total of 78 students. Each classroom received 3, 45-60 minute lessons on three separate visits. All classrooms received the lessons entitled “Start with Seeds” and “My Totally Tasty Plants”. Three of the four classrooms used “Designing Plants” as their last lesson while the fourth used “Being Loyal to the Soil” (Table 2). The lessons were selected based on the preference and familiarity of content matter of the youth specialist. The youth specialist had packets containing a description of the project, parent surveys, and a teacher survey. These packets were given to the classroom teachers after the completion of the last lesson. Two weeks after the last lesson was completed,

parents or guardians were requested to complete the survey and return it back to the teacher.

Teachers sent a reminder note card home one week after the surveys were distributed.

Teachers returned completed surveys to us via a pre-paid envelope. The youth specialist had no contact with completed surveys.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (version 12.0 for Windows98; SPSS, Chicago). Descriptive statistics included frequencies and percentages. Data collected from yes and no responses were transcribed into numeric values. Due to the dichotomous nature of the data and the non-symmetric population probability distribution, a Sign test with alpha 0.05 was used to define significance of the number of positive or negative responses. Additional analysis for non parametric correlation between question responses and demographic information was performed using Chi Square and Kendall's Tau b (alpha 0.05) in conjunction with crosstabulations.

Results and Discussion

Out of the 78 parental surveys distributed, 47 were returned for a return rate of 60.2%. There was a slightly higher percentage of female children (57.4%) represented by the returned surveys as opposed to male children (42.6%). Most of the respondents either lived in small towns with less than 5000 people (40.4%), or did not respond to this particular question (31.9%). The remaining respondents indicated they lived in communities composed of 5,000 to 15,000 persons (19.1%) or 25,000 or more persons (8.5%). While a majority of the children were Caucasian (78.7%), nearly 20% were minority of either Hispanic (10.6%) or

Bosnian (10.6%) ethnicity. Of the respondents who answered if they qualified for free or reduced lunch programs, 35.6% answered “Yes” putting their annual income for a family of four at or below \$34,873 (USDA, 2005). These results correspond closely with the overall composition of the state of Iowa with the exception of the ethnic distribution. The percentage of minority students was quite high when compared to the low minority population (6.1 %) of the state of Iowa (USCB, 2005).

In addition to basic demographic information, questions regarding the child’s exposure and interactions with gardening and cooking were also asked (Table 3). Many children had a flower (59.6%), or vegetable (23.4%) garden at home, but 14.9% came from homes lacking trees or shrubs and 10.6% were without lawns. Nearly half of the parents surveyed said they gardened with their child (47.7%). The majority of parents (78.7%) said they cooked with their child and 56.7% of survey respondents indicated they did so at least once a week. The high level of involvement the parents had with their children prior to the GITG lessons may have negatively influenced the potential for positive change in the nutritional subject area. Previous studies have found that students with the most need or room for improvement tend to display greater change in attitudes resulting in significant assessment results (Koch et al, 2005).

Two of the four science questions revealed significant positive responses (Table 1). The majority of parents observed an increase in their child’s interest in researching their questions (75.6%). Eighty percent of respondents noted an increased ability to distinguish between living and non-living things, a K-4 Science content standard (National Science Foundation, 1999). The majority of students did not have an increased interest in the origin of their foods (plant vs. animal) or increased interest in the identification or names of plants.

Each of the lessons presented contained a science theme which may have contributed to the overall positive impact observed in the area of science. These results are quite positive when compared to another hands-on science curriculum study conducted in Wisconsin (Lattery et al., 2002). In that study, attitudes towards science of first grade students declined after 15h of instruction over an 8 week period, compared to their traditional instruction control group.

One of the four questions targeting nutrition received a majority of positive responses (Table 1). The question “Has your child shown an increased interest in eating or at least trying new fruits or vegetables at home or at restaurants?” had a 59.6% positive response rate. Questions regarding increased interest in the identification or origin of produce and identification of food groups received positive response rates of 50 and 45.7% respectively. Only 21.7% (significantly less than half, $P < 0.001$) of parents noticed an increase concerning the origin or food group designation of packaged food products. This result was not surprising as the concept of packaged food origination was not presented in any of the lessons used in this study. It is, however, a theme in another first-grade lesson within the GITG curriculum.

All of the questions targeting environmental awareness received a majority of positive response rates, (Table 1) and two questions revealed statistically significant results. The questions that asked “Has your child shown an increased awareness of environmental issues by conserving water, noticing car exhaust, picking up trash, avoiding littering, or any other similar action?” and “Has your child shown an increased interest in gardening?” received positive response rates of 57.8 and 56.5%, respectively. The other two questions which asked “Has your child shown an increased interest in the health or care of plants either inside or outside of your home?” and “Has your child shown an increased respect for

landscape plantings such as walking around or stepping over planted areas?” had much higher positive response rate of 71.7 and 78.7%, respectively. Parents reported positive changes in their child’s reactions and interests regarding environmental awareness after receiving GITG lessons indicating that the curriculum impacted environmental awareness and interests of first-graders.

Five correlations were found between demographic categories and the 12 survey questions asked (Table 4). Parents who indicated they did not garden with their child were less likely to observe their child exhibiting increased interest in origins of foods, interest in identification of plants, or respect for landscape plantings. Parents who indicated they did garden with their child and those who cooked with their child were more likely to observe an increased interest in gardening as opposed to parents that did not garden or cook with their children. While 80% of all parents indicated their child displayed an increased ability to distinguish between living and non-living things, (Table 1) the remaining 20% of parents all had female children (Table 4). Possible explanations for all male parents reporting positive change in this area include increased attention to scientific abilities by parents of male students, advanced science ability by female students before exposure to the GITG lessons, or a difference in impact based on classroom delivery, all of which relate to issues of gender in the classroom (Sanders, 1997). No correlations were found relating to town size or economic status of the students and parental responses to survey questions. The limited number of correlations present suggests that factors such as socio-economic status, ethnicity, and gender did not influence the overall success of the lessons.

Conclusions

Results indicate that three GITG lessons positively impacted the interests and awareness of first-graders in this study in the areas of science and environmental awareness. A statistical majority of parents noted change in these areas. Each of the categories of science, nutrition, and environmental awareness received positive response rates in excess of 50% for at least one of the four questions presented per subject. The low percentage of parents who noticed change in nutritional attitudes or interests supports the validity of the survey instrument as students received minimal exposure to nutritional lessons. Other lessons within the GITG curriculum place greater emphasis on nutritional concepts.

Study Limitations

Time available for instruction is of concern when considering the effectiveness of any curriculum (Hong, 2001; Soloway et al., 2000). The amount of classroom time devoted to GITG lessons was a limiting factor in this study. The amount of positive changes in awareness and interest observed after only three hours of instruction were quite promising. Smith and Motsenbocker (2005) reported increased science achievement score in only one of three classes receiving 12.5h of garden-based lessons. Increased contact hours may increase positive parental observations; however other variables may contribute to the effectiveness of a curriculum more than time, such as overall teaching experience of the instructor, content familiarity, or instructor enthusiasm (Lattery et al., 2002; Owen et al., 1997).

The use of a single instructor to implement the GITG lessons was considered a benefit to improve consistency but could also hinder full impact of a curriculum. Use of a classroom teacher allows for knowledge of classroom dynamics, individual student needs and abilities, and awareness of prior knowledge to be used to strengthen the learning experience.

The survey questions were designed to cover content found throughout the GITG curriculum. The questions did not directly relate to the content of the specific lessons used, as the lessons chosen for use were at the discretion of the youth specialist. This may explain the limited parental observations of change for certain questions. The overall number of positive responses despite the lack of direct correlation may indicate prior knowledge or a broader range of impact for the lessons used.

Research in the area of horticulture education has many complications and confounding variables not present in the more quantitative research involving plants (Phibbs and Relf, 2005). Evaluation at this early age can be challenging, but the earlier a child is exposed to concepts and ideas the greater the potential for attitudinal or behavioral change (Lineberger and Zajicek, 2000). While a voluntary parental survey resulted in a smaller sample size than a student survey, it allowed for increased accuracy compared to self-evaluation. Due to the smaller sample size, the findings presented should not be generalized beyond the scope of the project, but rather used as a guide for future research.

Further studies directed at outcome evaluation on an individual lesson basis, a larger sample size, and increased time allocations are recommended before conclusions can be made on the GITG curriculum as a whole.

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Table 1. Sign test results and proportion of positive (yes) responses from a garden-based curriculum assessment survey. Data were derived from a parental survey distributed after first-grade students in Iowa received lessons from the *Growing in the Garden*² curriculum.

Category and question	Responses			
	n	Missing	Positive (%)	P
Science				
a) Has your child shown an increased interest in the origin of their foods such as which part of a plant is eaten or if food is from plants or animals?	45	2	37.8	0.135
b) Has your child shown an increased ability to distinguish between living and non-living things?	45	2	80.0	<0.001*
c) Has your child shown an increased interest in searching for explanations to their questions?	45	2	75.6	<0.001*
d) Has your child shown an increased interest in the identification or names of plants?	46	1	43.5	0.461
Nutrition				
a) Has your child shown an increased interest in eating or at least trying new fruits or vegetables at home or at restaurants?	47	0	59.6	0.243
b) Has your child shown an increased interest in produce when at the grocery store or market such as what something is or where it is grown?	46	1	50.0	1.0
c) Has your child shown an increased interest in identifying the food groups represented at meals or snack time?	46	1	45.7	0.659
d) Has your child shown an increased interest in packaged food products such as what it is made out of (ie. pasta = grains) or which food group it is in?	46	1	21.7	<0.001*
Environmental awareness				
a) Has your child shown an increased respect for landscape plantings such as walking around or stepping over planted areas?	47	0	78.7	<0.001*
b) Has your child shown an increased awareness of environmental issues by conserving water, noticing car exhaust, picking up trash, avoiding littering, or any other similar action?	45	2	57.8	0.371
c) Has your child shown an increased interest in the health or care of plants either inside or outside of your home?	46	1	71.7	0.004*
d) Has your child shown an increased interest in gardening?	46	1	56.5	0.371

² A garden-based curriculum for grades K-3 developed by Iowa State University Extension in 2000.

*Significant at P< 0.05.

Table 2. Descriptions of *Growing in the Garden*^z lessons delivered to first-grade students in Iowa participating in a curricular assessment project.

Lesson Title	Grade level	Content objective	Life skill objective	Subjects	Survey Category
Start with seeds	K	Learn characteristics of seeds	Sorting and experimenting	Science, language arts	Science Environment
My totally tasty plant	1	Develop awareness of edible parts of plants	Identification	Science, health, art	Science Nutrition
Designing plants	1	Identify the basic parts of the plant and their function	Critical thinking and communications	Science, language arts, art, music	Science Environment
Be loyal to the soil	1	Understand that good soil is limited in nature and needs to be protected	Responsibility	Science, math	Science Environment

^z A garden-based curriculum for grades K-3 developed by Iowa State University Extension in 2000.

Table 3. Results of 2005 parental survey of first-grade students in Iowa receiving Growing in the Garden^z lessons.

Question	Responses (no.)	Proportion of Responses (%)
a) The child's primary home has	47	100.0
Vegetable garden	11	23.4
Flower garden	28	59.6
Container garden	6	12.8
Trees and/or shrubs	40	85.1
Lawn	42	89.4
b) Do you garden with your child	44	100.0
No	23	62.3
Yes	21	47.7
How Often		
4x per week or more	0	0.0
2-3x per week	1	4.8
1x per week	4	19.0
2x per month	0	0.0
1x per month	1	4.8
Other	11	52.4
Missing	4	19.0
c) Do you cook with your child	47	100.0
No	10	21.3
Yes	37	78.7
How Often		
4x per week or more	7	18.9
2-3x per week	7	18.9
1x per week	7	18.9
2x per month	1	2.7
1x per month	3	8.1
Other	7	18.9
Missing	5	13.5

^z A garden-based curriculum for grades K-3 developed by Iowa State University Extension in 2000.

Table 4. Significant correlations between survey questions and demographic information from a curricular assessment project. Data were analyzed with Chi Square, Kendall's Tau b, and crosstabulations using the Statistical Package for the Social Sciences (SPSS).

Category	Survey Question	Demographic Question	Survey Response	Demographic Response ^z		P
Science	Has your child shown an increased interest in the origin of their foods such as which part of a plant is eaten or if food is from plants or animals?	Do you garden with your child	Yes No	Yes 11 10	No 5 17	0.048*
Science	Has your child shown an increased interest in the identification or names of plants?	Do you garden with your child	Yes No	12 8	6 17	0.026*
Environment	Has your child shown an increased respect for landscape plantings such as walking around or stepping over planted areas?	Do you garden with your child	Yes No	19 2	15 8	0.048*
Environment	Has your child shown an increased interest in gardening?	Do you garden with your child	Yes No	17 3	9 14	0.002*
		Do you cook with your child	Yes No	23 12	3 7	0.046*
Science	Has your child shown an increased ability to distinguish between living and non-living things?	Sex of the child		M Yes 19 No 0	F 17 9	0.005*

^z M =Male; F = Female

* Significant at P< 0.05.

CHAPTER 4. CONCLUSIONS

As the interest in school gardens has increased, so has the amount of research relating to children and horticulture. The positive connections found between children and horticulture has prompted the development of garden-based curricula. Iowa State University Extension developed the *Growing in the Garden* (GITG) curriculum, but at the time of this study, it had yet to undergo formal assessment.

This study examined if the GITG curriculum could positively impact the attitudes and or interest of first graders in the areas of science, nutrition, and environmental awareness. Results indicate that three GITG lessons positively impacted the attitudes and interest of first-graders in this study in the areas of science and environmental awareness. A statistical majority of parents noted change in these areas. The results suggest that the GITG curriculum can be effectively utilized in first-grade classrooms to encourage positive attitudes towards and increase interest in science and the environment.

Data were collected in the form of a parental questionnaire. In addition, classroom teachers were also asked to comment on post-lesson behaviors of their first-grade students. Their comments made were as follows.

“They (first grade students) notice plant parts in books and outside. They are interested in planting seeds.”

“(There are) more scientific discussions and observations of nature outside and inside working on their plant unit.”

“They have loved studying plants! They are very interested in checking the progress of the different things we have planted.”

“At lunch they have talked about eating the flower or root of plants when they take broccoli and carrots from the salad bar.”

“Students are familiar with vegetables and fruits with seeds. They refer to some of the things Ms. Cook showed them and allowed them to taste.”

“(They are) very much more aware. We have placed great emphasis on this (environmental awareness) since spring started and different parents have mentioned how their children are teaching them!”

In addition to supporting the positive findings in the areas of science and environmental awareness, these statements also mentioned observations made concerning nutritional interests. Positive increases in nutritional attitude and interests were perceived by some parents, though not enough to constitute a statistical majority. This was not surprising as nutrition was not emphasized in the lessons presented. The positive impact observed was quite encouraging considering the few lessons and limited amount of instructor contact in this study. Findings from this study are an important first step in proving impacts of GITG. It is hoped that these results may increase the use of the curriculum by schools.

Future Research

Classroom time was a limiting factor in the amount of lessons that were able to be presented in this study. The amount of positive changes in attitudes and interest observed

after only three hours of instruction were quite promising. Increased contact hours may increase positive parental observations.

The survey questions were designed to cover content found throughout the GITG curriculum. The actual lessons used in the study did not correlate specifically with each of the survey question as the lessons chosen for use were at the discretion of the youth specialist.

Further studies directed at outcome evaluation on an individual lesson basis, a larger sample size, and increased time allocations are recommended before conclusions can be made on the GITG curriculum as a whole.

APPENDIX

Parental Survey Instruments

Teacher Survey Instrument

Reminder Postcard

Parental Survey Instrument

English Version

Dear Parent or Guardian,

Your child is currently participating in Growing in the Garden lessons through their school classroom curriculum. The following questionnaire is part of a study to assess garden-based curriculum for effects on interests and behaviors of kindergartners and first-graders in the areas of science, environmental awareness, and nutrition. As your child's primary caregiver, you are being asked to participate by observing and commenting on your child's behaviors.

The questionnaire should take approximately 10 to 15 minutes to complete. You may skip any question for any reason. All responses will be strictly confidential and combined with others for use in statistical analysis. No individual data will be reported. Once completed, please return the questionnaire to your child's teacher.

Thank you in advance for your assistance with this important research project. We look forward to sharing the results of this project in the near future. If you have any questions, please feel free to contact us.

Sincerely,

Kimberly R. Hilgers
Graduate Student
khilgers@iastate.edu
294-2503

Cynthia Haynes
Assistant Professor
chaynes@iastate.edu 515-
515-294-4006

If you have any questions about the rights of research subjects or research-related injury, please contact Ginny Austin Eason, IRB Administrator, (515) 294-4566, austingr@iastate.edu, or Diane Ament, Research Compliance Officer, (515) 294-3115, dament@iastate.edu.

Assessing Effects of a Garden-Based Curriculum on Behavior in Kindergarteners and First-Graders

Instructions: Please answer the following questions as accurately and honestly as possible. Circle your answer/s. Please write any additional information or observations in the space provided below each question.

Student Information

Sex: Male Female Grade: K 1st

Child's ethnicity:

Caucasian African American Asian Latino Other _____

Size of town you live in:

< 500 500-5,000 5,000-15,000 15,000-25,000 25,000-50,000 over 50,000

Child's primary home has: (circle all that apply)

vegetable garden flower garden container garden trees and/or shrubs lawn

Yes / No Does your child qualify for free or reduced lunches?

Yes / No Do you garden with your child? How often? _____

Yes / No Do you cook with your child? How often? _____

Parent Observations

1.) Yes / No Has your child shown an increased interest in eating or at least trying new fruits or vegetables at home or at restaurants?

2.) Yes / No Has your child shown an increased respect for landscape plantings such as walking around or stepping over planted areas?

3.) Yes / No Has your child shown an increased interest in the origin of their foods such as which part of a plant is eaten or if food is from plants or animals?

4.) Yes / No Has your child shown an increased awareness of environmental issues by conserving water, noticing car exhaust, picking up trash, avoiding littering, or any other similar action?

5.) Yes / No Has your child shown an increased ability to distinguish between living and non-living things?

6.) Yes / No Has your child shown an increased interest in the health or care of plants either inside or outside of your home?

7.) Yes / No Has your child shown an increased interest in gardening?

8.) Yes / No Has your child shown an increased interest in produce when at the grocery store or market such as what something is or where it is grown?

9.) Yes / No Has your child shown an increased interest in searching for explanations to their questions?

10.) Yes / No Has your child shown an increased interest in identifying the food groups represented at meals or snack time?

11.) Yes / No Has your child shown an increased interest in packaged food products such as what it is made out of (ie. pasta = grains) or which food group it is in?

12.) Yes / No Has your child shown an increased interest in the identification or names of plants?

Thank you for participating in this survey!

Please return this form to your child's teacher.

Parental Survey Instrument**Spanish Version**

Estimado(a) Padre/Madre o Tutor,

Actualmente su hijo está participando en lecciones que se llaman Creciendo en el Huerto (Growing in the Garden) en su escuela. El siguiente cuestionario es parte de un estudio para evaluar la educación sobre temas de jardinería para analizar los efectos en los intereses y conductas de niños en el kinder y primer grado en las áreas de ciencia, conciencia del medioambiente y la nutrición. Como la persona principalmente responsable por el cuidado de su hijo(a), se le solicita participar con observar y comentar sobre los comportamientos de su hijo(a).

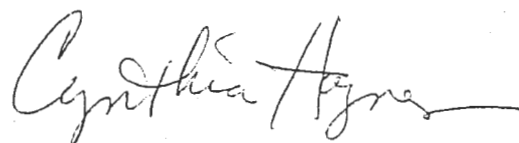
Debe poder completar el cuestionario en aproximadamente 10 a 15 minutos. Puede saltar cualquier pregunta por cualquier razón. Todas las respuestas se mantendrán confidenciales y serán combinadas con otras para poder realizar análisis estadística. No se reportarán datos individuales. Una vez completado el cuestionario, favor de devolverlo a la maestra de su hijo(a).

Le agradecemos de antemano su asistencia con este proyecto de investigación importante. Nos complacerá compartir los resultados de este proyecto con usted en un futuro muy cercano. Si tiene cualquier pregunta, no dude en contactarnos.

Atentamente,



Kimberly R. Hilgers
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515-294-2503



Cynthia Haynes
Assistant Professor
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Si tiene cualquier pregunta sobre los derechos de los participantes en la investigación o heridas relacionadas con la investigación, favor de comunicarse con Ginny Austin Eason, Administradora de IRB, (515) 294-4566, austingr@iastate.edu, o Diane Ament, Research Compliance Officer, (515) 294-3115, dament@iastate.edu.

Cómo Evaluar los Efectos de un Plan de Estudios basado en la Jardinería en la Conducta de niños en el Kinder o Primer Grado

Instrucciones: Favor de contestar las siguientes preguntas de la manera más precisa y honesta posible. Subraye su(s) respuestas. Favor de escribir cualquier información o observaciones adicionales en el espacio después de cada pregunta.

Información del estudiante

Sexo: Masculino Femenino Grado: K 1^{er}

Grupo étnico:

Caucasiano Afro Asiático Latino Otro _____
Americano

Población de la ciudad donde vive:

< 500	500-5,000	5,000-15,000	15,000-25,000	25,000-50,000	más de 50,000
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La casa principal del niño tiene: (subraye todas las que apliquen)

huerto de verduras	jardín de flores	jardín en recipientes	árboles y/o arbustos	césped

Sí / No ¿Califica su hijo para comidas gratuitas o de precio reducido?

Sí / No ¿Practica usted la jardinería con su hijo? ¿Con qué frecuencia? _____

Sí / No ¿Cocina con su hijo? ¿Con qué frecuencia?

Observaciones del padre (de la madre)

1.) Sí / No ¿Ha demostrado su hijo más interés en comer o por lo menos probar nuevas frutas o verduras en la casa o en restaurantes?

2.) Sí / No ¿Ha demostrado su hijo más respeto para plantas en los jardines como por ejemplo caminar alrededor de o evitar pisar las áreas plantadas?

3.) **Sí / No** ¿Ha demostrado su hijo más interés en el origen de sus comidas, por ejemplo, cuál parte de una planta se come o si una comida es de plantas o animales?

4.) **Sí / No** ¿Ha demostrado su hijo una mayor conciencia de asuntos medioambientales con conservar agua, fijarse en los gases de combustión de los carros, recoger basura, evitar tirar basura o cualquier otra acción semejante?

5.) **Sí / No** ¿Ha demostrado su hijo una mayor habilidad de distinguir entre cosas animadas y inanimadas (i.e., vivas y no vivas)?

6.) **Sí / No** ¿Ha demostrado su hijo un interés creciente en la salud o cuidado de plantas ya sea dentro de o fuera de su casa?

7.) **Sí / No** ¿Ha demostrado su hijo un interés creciente en la jardinería?

8.) **Sí / No** ¿Ha demostrado su hijo mayor interés en las hortalizas cuando está en el supermercado o mercado preguntando que algo es o donde se cultiva?

9.) Sí / No ¿Ha demostrado su hijo un interés creciente en buscar explicaciones para sus preguntas?

10.) Sí / No ¿Ha demostrado su hijo mayor interés en identificar los grupos alimenticios representados en las comidas o los bocadillos?

11.) Sí / No ¿Ha demostrado su hijo mayor interés en los alimentos empaquetados preguntando de qué se hace (ie. pasta = granos) o en cuál grupo alimenticio pertenece?

12.) Sí / No ¿Ha demostrado su hijo mayor interés en la identificación o el nombre de las plantas?

¡Gracias por su participación en este cuestionario!

Favor de devolver la presente a la maestro de su hijo.

Parental Survey Instrument

Bosnian Version

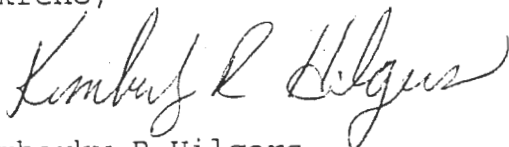
Postovani roditelji ili staratelji,

Vase dijete trenutno sudjeluje u lekcijama rast u vrtu kros njihov skoski razredni plan. Sledeca pitanja su dio učenja o vrtarstvu-zasnovan na planu nastave za efekat intersea I ponasanja dijecijeg vrtica I prvih razreda u podrucju prirodnih nauka, ekoloski znacaj, I ishrana. Kao dijeciji osnovni brinulac I davatelj, mi pitamo vas da sudjelujete u nadgledanj, I komentiranju na ponasanje vasesg dijeteta.

Da bi popunili pitanja potrebno je odprilike oko 10 do 15 minuta. Vi mozete da preskocite bilo koje pitanja zbog bilo kojeg razloga. Svi odgovori ce biti potpuno u tajnosti I bit ce kombinovani sa drugim za statisticke analize. Ni jedan pojedinacni izvjestaj nece biti prijavljen. Kad popunite, molim da vratite ova pitanja nastavniku vasesg dijteta.

Hvala vam unaprijed za vasu pomoc sa ovim veoma vaznim projektom. Mi gledamo unaprijed da dijelimo rezultate ovog projekta u skoroj buducnosti. Ako vi imate bilo kakvih pitanaj, osjecajte se slobodno da kontaktirate sa nama.

Iskreno,



Kimberky R. Hilgers

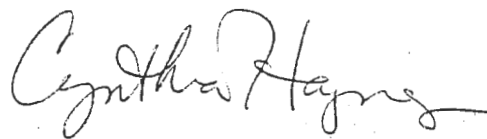
Cynthia Haynes

Diplomirani student

Pomocnik profesora

khilgers@iastate.edu

chaynes@iastate.edu



Ako vi imate bilo kakvih pitanja u vezi prava od ovog predmta istrazivanja ili osleda povezana sa ovim istrazivanjm, molimo vas da kontaktirate sa Ginny Austin Eason, IRE direktorom, (515) 294-4566, austingr@iastate.edu, ili Diane Ament, istrazni ofisir, (515) 294-3115, dament@iastate.edu.

Efektivni osnovani plan gradiva o vrtarstvu I ponasanju
dijecijeg vtica I prvih razreda.

Upustva: Molimo vas da odgovorite na sledeca pitanja tacno I
iskreno sto je moguće. Zaokruzite svoje odgovore. molimo vas
napisite bilo koje dodatne informacije ili posmatranje u
prostoru koje je obezbjedeno ispod svakog pitanja.

Informacije o učeniku

Pol: Musko Zensko Razred: K lvi

Etnicko porijeklo dijeteta:

Bijelac African Asian Latino Drugo _____
American

Velicina grad u kojem vi zivite (broj stanovnika):

<500 500-5,000 5,000-15,000 15,000-25,000 25,000-50,000 preko 50,000

Dijetetovo trenutno boraviste (kuca) ima: zaokruzite jedno

Vrt	Vrt	Vrt	drveca I\ili	travnik
Sa povrcom	sa cvijecem	sa kontejnerom	zbunje	

Da\Ne Dali se vase dijete kvalifikuje sa besplatnu\snizenu hranu?

Da\Ne Dali vi radite vrtarstvo sa svojim dijetetom? Kako
cesto? _____

Da\Ne Dali vi kuhate sa svojim dijetetom? Kako cesto? _____

Roditeljovo posmatranje

- 1.) Da\Ne Dali je vase dijete pokazalo porast u interesu da
jede ili bar da proba novo voce ili povrce kod kuće ili u
restoranu?

- 2.) Da\Ne dali je vase dijete pokazalo porast postovanja prema posadenim biljkama kao sto je hodanje okolo ili gazenje po posadenoj površini?
- 3.) Da\Ne Dali je vase dijete pokazalo interes porijeklo od njihove hrane kao sto je koji dio povrca se jede ili odakle hrana potica od biljke ili zivotinje?
- 4.) Da\Ne Dali je vase dijete pokazalo interes za okolinu nastajanje vode, primjecivanje izlazenje gasa iz auta, kupljenja smeca, izbjegavanja zagadivanja \bacanja sameca ili bilo koji slicni drugi akcija?
- 5.) Da\Ne Dali je vase dijete pokazalo interes I sposobnost u razlikovanju zivih I nezivih bica?
- 6.) Da\Ne Dali je vase dijete pokazalo interes za zdravlje I za brigu biljaka u kuci ili van kuce?
- 7.) Da\Ne Dali se je u vases dijete povecao interes u vrtatstvu?

8.) Da\Ne Dali je vase dijete pokazalo interes u produktima kada je u prodavnici ili na pijaci kao sto je odakle je doslo I gdje raste?

9.)Da\Ne dali je vase dijetet pokazalo interes u istrazivanju za objasnjenje na njihova pitanja?

10.)Da\Ne Dali je vase dijete pokazalo interes u razlikovanju o grupi hrane predstavljene za obrok ili zalogaj vrijeme (snack)?

11.) Da\Ne Dali je vase dijete pokazalo interes o pakovanim proizvodima hrane kao sto je od cega je napravljeno(pasta=zito) ili kojoj grupi hrane pripada?

12.)Da\Ne Dali je vase dijete dijetet pokazalo interes u raspoznavanju ili imenovanju biljaka?

Hvala vam sto ste sudjelovali u ovom ispitivanju|izvjestaju!
Molim da vratite ovu formu nastavniku vasesg dijeteta.

Teacher Survey Instrument

Assessing Effects of a Garden-Based Curriculum on Behavior in Kindergarteners and First-Graders

Teacher Survey

School Name _____

Grade Taught _____

How many students are in your classroom? _____

How many ILP students do you have? _____

How many of your students qualify for reduced/free lunches? _____

Please list the Growing in the Garden lessons used, the dates started, the length of time for completion, and the lesson sections completed.

Lesson Title	Date Started	Time spent on lesson	Check Sections Completed		
			Do	Reflect	Apply
1.)					
2.)					
3.)					
4.)					
5.)					

How long have you been using Growing in the Garden lessons in the classroom?

first year

second year

third year

> three years

Yes No Were there any events or circumstances that took place that might influence the students' experience with the Growing in the Garden lessons? For example: a teacher change, traumatic event, construction within the classroom, etc. If Yes, please explain.

Have you observed any noticeable changes in your students' behavior or understanding in the following areas? If so, please specify.

Science

Nutrition

Environmental Awareness

Thank you for participating in this survey!

*** Please return this survey along with the completed Parent Surveys, in the pre-paid envelope provided.**

Reminder Postcard**REMINDER**

You were recently sent a questionnaire concerning the behaviors and interest of your child after participating in the Growing in the Garden Program. Your input is very important to us. Please return the completed questionnaire to your student's teacher. Your input is very important to us. If you did NOT receive a survey or are in need of a second copy, please call me at (515) 294-2503. Thank you in advance for your participation in this important study!

Kimberly R. Hilgers, Graduate Student